NEXT NORDIC GREEN TRANSPORT WAVE - LARGE VEHICLES

Supplementary note: Business potential in the Nordic Region

Deliverable 4.3:
Perspectives and potentials for hydrogen & fuel cell buses in the Nordic Region
December 2021 - updated February 2022

Nordic Innovation

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Next Wave - about the project

Electrification of the transport sector already began and the Nordic countries, specifically Norway and Iceland, have taken major steps resulting in battery electric vehicles (BEVs) already accounting for a substantial percentage of the total sales. The world is looking towards the Nordics as they are providing global examples for success. However, little is happening regarding larger vehicles as battery solution still are not able to provide heavy-duty users (e.g., buses, trucks and lorries) the mobility they need.

Fuel cell electric vehicles using hydrogen as a fuel can solve this. The project focuses on providing infrastructure for a large-scale deployment of trucks, buses and lorries. The goal is to further stimulate the global technological lead, which the Nordic countries have by stimulating the very first hydrogen infrastructure roll-out for larger vehicles while at the same time map how the infrastructure build-up needs to be done, so that the transition to hydrogen vehicles can happen smoothly. Such roll-out will also benefit the use of hydrogen for trains and the maritime sector. Furthermore, in addition of sourcing the hydrogen as a by-product from the industry, in the Nordic region we have the unique opportunity to produce the hydrogen in a green manner exploiting renewable electricity production.

Already, Nordic industries have taken international lead in the field of hydrogen and fuel cells and a unique cooperation exists between "hydrogen companies" via the Nordic Hydrogen Partnership (former Scandinavian Hydrogen Highway Partnership, SHHP) cooperation. Jointly they have marketed the Nordic platform for hydrogen and, at the same time, paved the way for vehicle manufacturers to deploy such vehicles in the Nordic countries. When it comes to hydrogen, the Nordics have globally leading companies both within the infrastructure and the fuel cell business. The project therefore sets forward four key activities in a unique project where technical innovation and deployment strategies are intertwined.

The project will deliver an analysis on large-scale transport of hydrogen with mobile pipeline, a description of the innovation and business potential for a roll-out of FC-buses in the Nordic region, as well as a coordinated action plan for stimulating the FC truck demand and a prospect for utilising hydrogen in heavy-duty equipment. Finally, the project will contribute to national and Nordic hydrogen strategy processes even providing input to a possible Nordic Hydrogen Strategy

Partners in Next Wave

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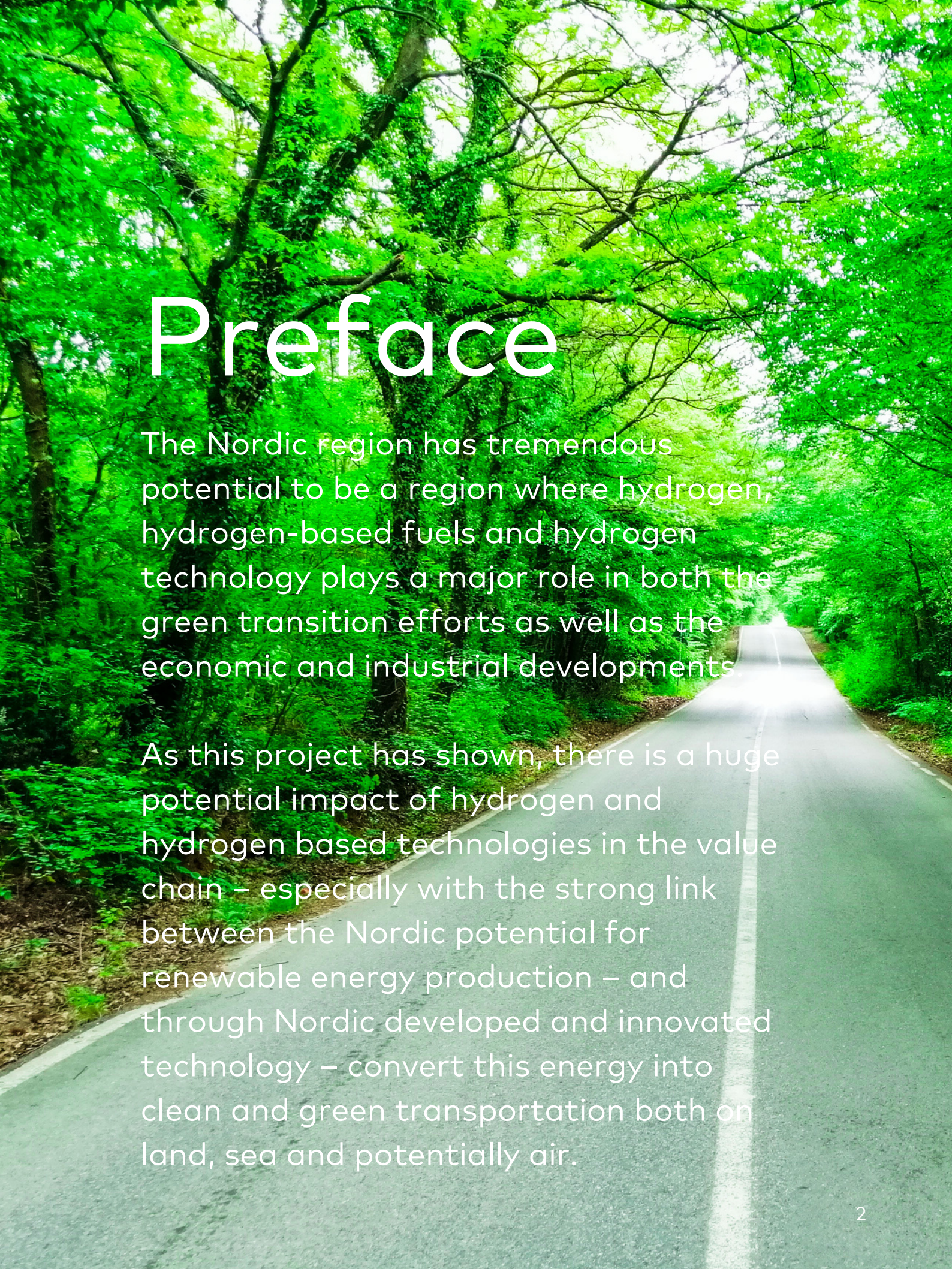


Preface

The Nordic region has tremendous potential to be a region where hydrogen, hydrogen-based fuels and hydrogen technology plays a major role in both the green transition efforts as well as the economic and industrial developments.

As this project has shown, there is a huge potential impact of hydrogen and hydrogen based technologies in the value chain – especially with the strong link between the Nordic potential for renewable energy production – and through Nordic developed and innovated technology – convert this energy into clean and green transportation both on land, sea and potentially air.

Introduction

As shown in "Perspectives and potentials for hydrogen & fuel cell buses in the Nordic Region", implementing a number of common standards and policy approaches would greatly benefit the Nordic countries' ability to deploy hydrogen and fuel cell busses in the public transport sector.

This would not only be a huge boost of green public transportation and a major climate initiative in an otherwise hard to decarbonize sector, it will also – especially in urban areas and regions – have the potential to improve air quality etc. Furthermore in both sparsely populated, as well as in the most urban, parts of the Nordics, where the power infrastructure for different reasons easily will be strained by the expanding need for electricity to power both private cars, heating etc., the deployment of Hydrogen and Fuel Cell busses will help minimize the needed grid investments and avoid charging strains on a potentially overburdened infrastructure. This is not a direct commercial value, but a general contributing that has to be included when looking at the overall case for Hydrogen and Fuel Cell busses.

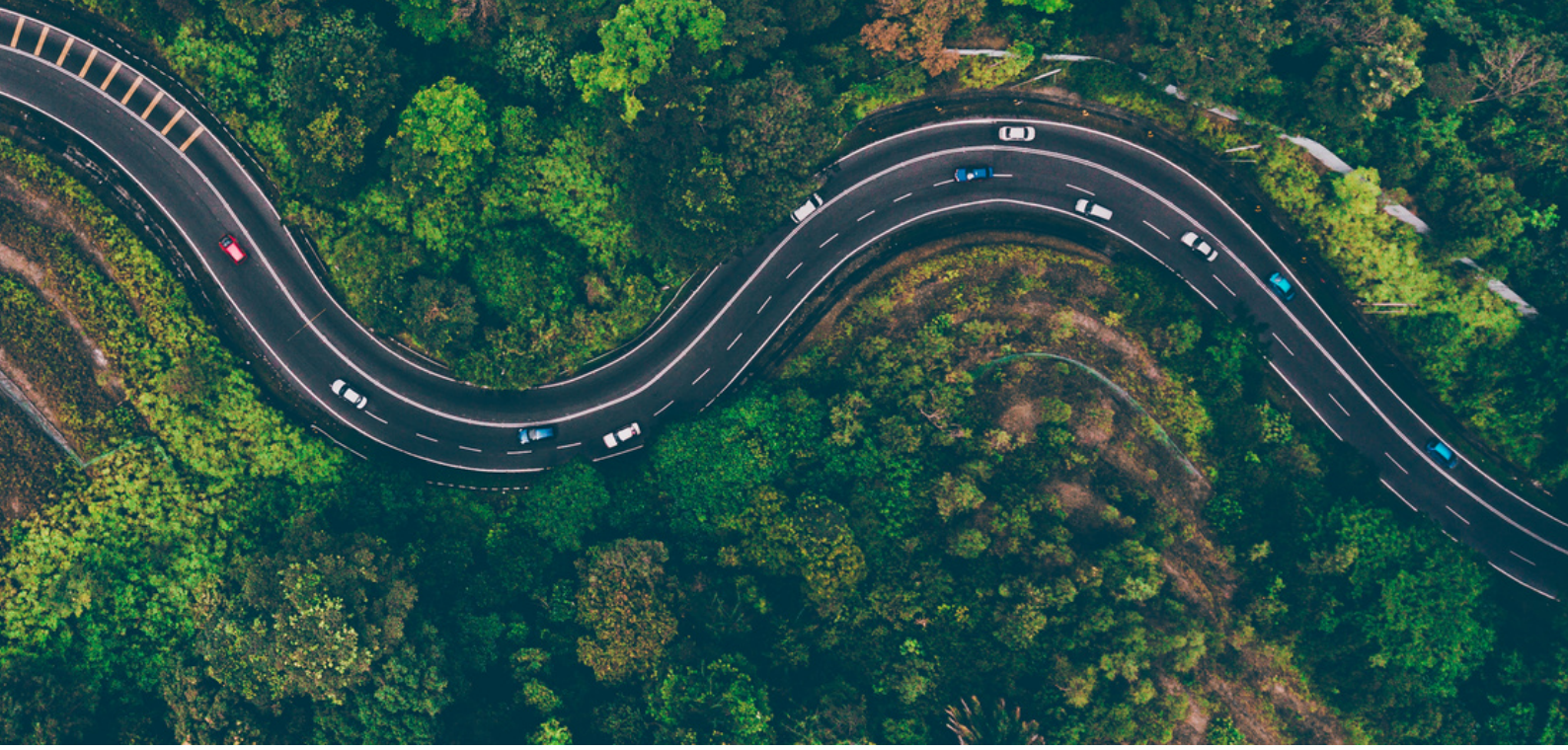
These are obviously the main impact of the deployment of hydrogen busses across the Nordics. However – a significant element in the deployment of hydrogen and fuel cell busses across the Nordics, is the substantial commercial impact from deploying these technologies, and thereby creating home market for the industrial Nordic players active in this field. This paper illustrates the strong Nordic value chain, and how innovation and deployment of these technologies can prove a commercial strength for the Nordic region.

Buses as a transition catalyst

Buses are a key factor in bringing innovative hydrogen and fuel cell technology to a commercial level in the transportation sector.

The buses represent a relatively large consumption of hydrogen (or hydrogen-based fuels), as well a very stable consumer, and traditionally on relative long-term contracts that enables operators, technology- and hydrogen suppliers to plan ahead and make the necessary first times investments etc.

To do this in your home market/region is a key benefit for the industry across the value chain.



Current bus fleet in the Nordics

As seen below, the number of units in operation in the Nordic countries are significant enough to be a substantial contribution to both climate and also for the development of hydrogen technology and value chains.

Country	Number of units
Denmark	8546
Finland	9955
Norway	16068
Iceland	1690
Sweden	13489

Total number of busses and coaches [1]

[1] https://www.acea.auto/publication/report-vehicles-in-use-europe-2022/

A Chain of Nordic Strength

Powering the transition

In this brief, we will exclude the power generation itself from the value chain description, since this sector is out of scope for the project and that power generation will be necessary for most zero-emission technologies in one form or the other. However – on a side note – it should be estimated that power sector, as well as the avoided grid expansion that is the result of the deployment of Hydrogen busses, represents a substantial value for society in itself.

Business potential in the Nordic Region

Commercial perspectives

1: Electrolysis

Hydrogen and fuel cell busses require the production of hydrogen and here the Nordic countries have a strong position within the fields of electrolysers.

This is the case with Danish company Green Hydrogen Systems, which for instance already has delivered an electrolyser to the bus refueling facility in Aalborg, Denmark. Furthermore, Norwegian Nel has a strong global presence within alkaline electrolysers and Danish Haldor Topsoe A/S is a global leader within SOEC electrolyser technology. Also, rapidly expanding startup and innovation company Stiesdal A/S, aims to be a leading global alkaline electrolyser and has already signed international contracts.

As such, the commercial base for Nordic electrolysers is strong and will be well suited for the further deployment of electrolyser technology.

A number of international companies are also active as electrolyser producers, but the nordics are very well suited in the international competition, not least as a result of years of innovation with partial public funding that has created the strong scientific base that now creates the foundation under the commercial development.

2: Refueling infrastructure

The next link in the value chain is the refueling of the busses, primarily and currently at 350 bar. This is a key component, since breakdowns of the refueling infrastructure is obviously critical to the entire operation of the bus-fleet. The production of refueling infrastructure is limited to a relatively small number of companies around the globe.

With the Norwegian company Nel's strong position in the market, where its Denmark based refueling division is a major global producer within this field. Especially when it comes to heavy-duty role infrastructure development and rollout a home market in the Nordic region would be of significant importance.

Commercial perspectives

3: Technology

The technology for the busses themselves, equally represents great commercial Nordic opportunities. The hydrogen storage onboard, as well as a part of the infrastructure for storage on-site, depots etc. is produced by The Hexagon Group in Norway.

The fuel cell stacks, a key technology component in a fuel cell bus, is manufactured by several companies across the Nordics. Swedish PowerCell is a world leader and this also goes for Ballard who, although a Canadian company, has its European facilities – including both service, manufacturing and innovation, placed in Denmark.

The manufacturing of busses themselves is another Nordic strongpoint. Although bus manufacturing, no matter the driveline – could be considered to be a Nordic stronghold and as such also benefit from commercial success with other drivelines than Hydrogen – manufacturing of the vehicles themselves, are still, with Volvo and Scania in Sweden as the regions most important OEM's a key part of the potential hydrogen and fuel cell bus commercial value chain.

4: Methanol

If not running on hydrogen, but instead on methanol, the value of refueling manufacturing is not present, since traditional fuel pumps can be used. However, electrolysers are still in play and companies with technology for methanol-production from CO2 and hydrogen such as European Energy or Haldor Topsoe A/S, are key players in the global marketplace.

Furthermore, the fuel cells for methanol-busses with HT-PEM technology are innovated and produced in the Nordics by Danish Company Blue World, and American Advent Technologies, which has its fuel cell daughter company, with both manufacturing and R&D located in Aalborg, Denmark.

Conclusion

1: The value chain is strong

Overall, no matter the solution, the hydrogen and fuel cell bus value chain is very strong in the Nordics and with EU-estimates that hydrogen can be directly linked to at least a million new jobs in 2030 [2], this creates a potential momentum for the Nordic countries in term of commercializing the technology.

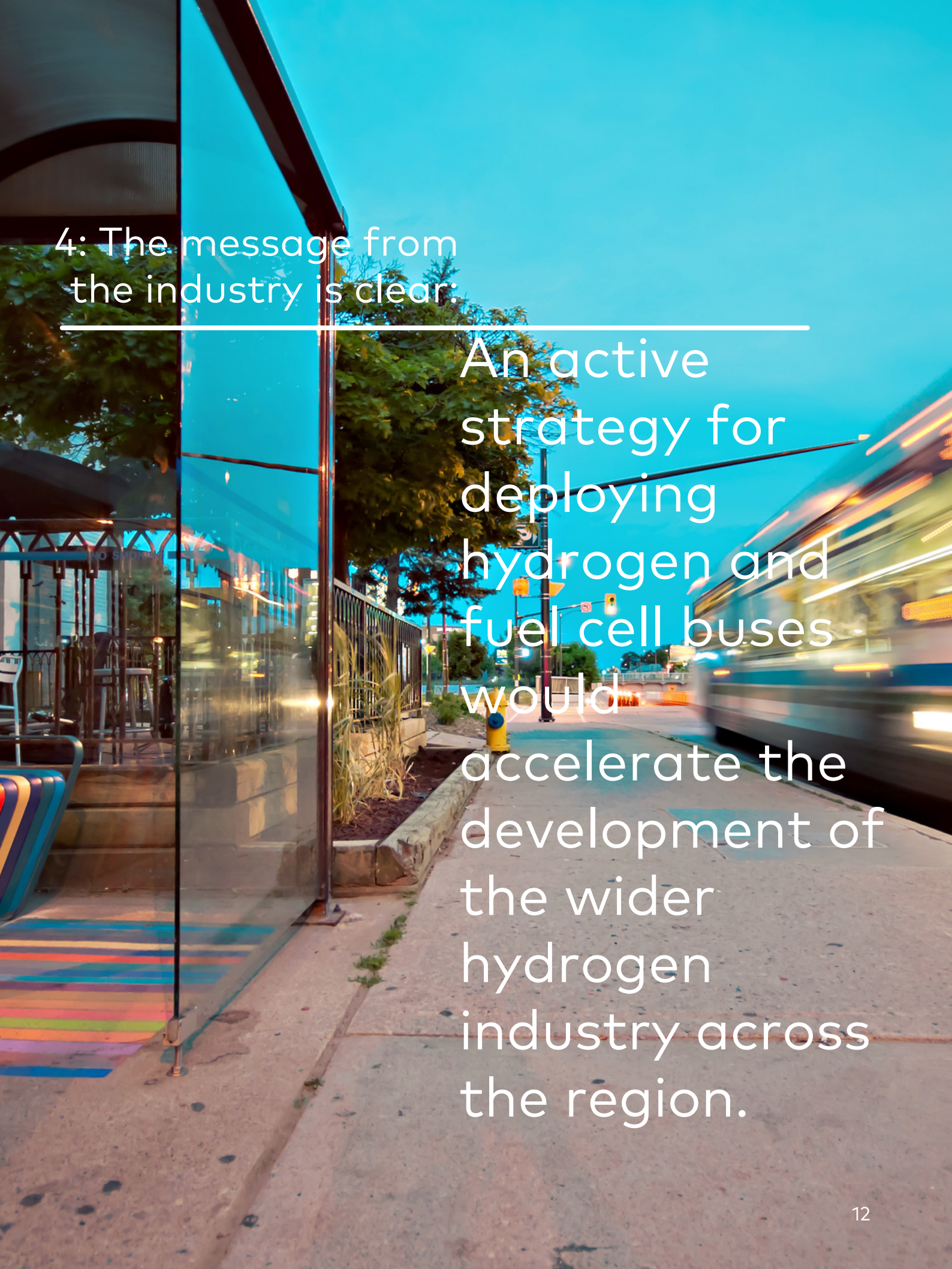
2: Further assessment needed

A final assessment of the commercial potential is a task beyond the Next Wave project, but rough estimates suggest that along the entire value chain a deployment of a significant amount of fuel cell busses would mean at least 15,000 jobs in the Nordics, not counting the running of the busses etc. which are not related to the technology that powers the busses.

3: Rollout depending on overall deployment

This is, however, a very rough and insecure estimate that also depends heavily on the overall development of hydrogen and hydrogen-based fuel technology in the Nordic region. The overall estimation talking to industry players across the region is however clear: an active strategy for the deployment of hydrogen and fuel cell buses is needed.

[2] EU Hydrogen Strategy
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301



4: The message from the industry is clear:

An active strategy for deploying hydrogen and fuel cell buses would accelerate the development of the wider hydrogen industry across the region.

Next Nordic Green Transport Wave - Large Vehicles

Deliverable 4.3

Supplementary note:
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Perspectives and potentials for hydrogen & fuel cell buses in the Nordic Region

Version 1.0

2021

Note on the updated content of the report:

While the Next Nordic Green Transport Wave project ended in 2021, the rapid development of the business potential in the Nordic region necessitated an update of the data in this supplementary note which was added in February 2022.

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